

Ministry of Health of Ukraine  
Ukrainian Medical Stomatological Academy

APPROVED  
at a meeting of the department  
disaster medicine  
and military medicine  
«\_\_\_\_» \_\_\_\_\_ 2020  
protocol № 2 from 28.08.2020



Head of Department

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**Methodical instructions  
for independent work of students  
during preparation for a practical (seminar) lesson  
and in class**

Training discipline	Training of reserve officers
Module № 1	Home care in extreme situations
The topic of the lesson	Bleeding and methods of stopping them External bleeding, premedical help.
Course	2
Faculty	foreign students training specialty "Medicine", "Stomatology"

## 2. Bleeding and methods of stopping them

**1. Relevance:** knowledge of clinical physiology of blood circulation is important for understanding the development of pathophysiological chains of acute disorders of this system. Given that morbidity and mortality from circulatory system pathology in Ukraine occupies 1 rank in the structure of pathology, the study of clinical students and knowledge of emergency care and intensive care in acute circulatory disorders is relevant and necessary.

Bleeding is one of the most difficult complications after injuries, injuries with damage to the main or peripheral vessels. No less a threat are internal bleeding with damage to the abdominal and thoracic organs. Timely cessation of bleeding determines and gives a chance for recovery. Mastering all methods of stopping bleeding increases the chances of survival of both military and civilians.

### 2. Specific objectives:

#### General:

- the cause and signs of external bleeding, the technique of stopping;
- home care for internal bleeding.
- physiology and pathophysiology of systemic circulation;
- physiology and pathophysiology of the microcirculation system;
- the concept of elastic, capacitive vessels and vessels of resistance;
- systemic oxygen transport;
- the concept of central venous and mean systolic pressure, their clinical significance;
- classification of various forms of acute circulatory disorders (fainting, acute heart failure, hypertensive crises)
- clinical signs of various forms of acute circulatory disorders;
- diagnostic criteria for acute circulatory disorders and methods of monitoring the effectiveness of prescribed therapy;
- Analyze the place of assistance
- Recognize critical bleeding
- apply direct pressure to the wound
- apply a tourniquet
- apply a turnstile
- apply a bandage
- Squeeze a tight wound tamponade
- check the correct application of the harness or turnstile
- use chemicals to stop the bleeding

**Competences and learning outcomes**, the formation of which is facilitated by the discipline (relationship with the normative content of training of higher education, formulated in terms of learning outcomes in the Standard).

In accordance with the requirements of the standard, the discipline provides students with the acquisition of *competencies*:



Term	Definition
<p>1. Bleeding</p> <p>2. Internal bleeding</p> <p>3. Internal bleeding is characterized by:</p> <p>4. Wound</p> <p>5. Chemicals to stop bleeding</p>	<p>Characterized by leakage of blood from damaged vessels into cavities, organs and surrounding tissues.</p> <ul style="list-style-type: none"> <li>- pale skin;</li> <li>- frequent weak pulse;</li> <li>- frequent breathing;</li> <li>- nausea, vomiting, thirst;</li> <li>- tachycardia, low blood pressure;</li> <li>- decrease in the level of hemoglobin, erythrocytes in the blood test;</li> <li>- excretion of blood with feces, urine, food.</li> </ul> <p>it is a violation of the integrity of the skin or mucous membrane with possible damage to adjacent tissues.</p> <p>chemicals that cause vasospasm (adrenaline) Sol. adrenalini hydrochloridi 0.1% - 1 ml, (norepinephrine) Sol. noradrenaline 0.2% - 1 ml. Vascular narrowing is caused by a drug such as ephedrine (Sol. Ephedrine hydrochloridi 5% - 1ml), but drugs such as naphthysine 10 ml, sanorin, galazoline, isadrine, novodrin, euspiran narrow blood vessels in inflammatory processes and do not cause bleeding. Calcium chloride (Sol. Calcii chloride 10% 10 ml), hemophobin (Sol. Haemophobini - 150 ml), fibrinogen (Sol. Fibrinogeni 250, 500 ml) take part in creating a convolution and stop bleeding. Hemophobin and fibrinogen are released in vials, obtained from donor</p>

<p>6. Esmarch's plait</p> <p>7. Temporary cessation of external bleeding, bleeding from damaged blood vessels.</p>	<p>blood plasma.</p> <p>has a length of 125 cm, a width of 2.5 cm, a thickness of 3-4 mm. At one end is a metal hook, at the other - a metal chain.</p> <ul style="list-style-type: none"> <li>- applying a pressure bandage;</li> <li>- increased position of the limb;</li> <li>- finger pressure of the artery in the projection of the location;</li> <li>- maximum flexion of the limb in the joint;</li> <li>- stop bleeding with a tourniquet;</li> <li>- stop bleeding with a tourniquet;</li> <li>- cessation of bleeding from the carotid artery by the method of Mikulich.</li> </ul>
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### **Theoretical questions for the lesson:**

1. Causes and signs of external bleeding.
2. The concept of critical external bleeding.
3. Methods and techniques for temporarily stopping external bleeding: lifting the limb, pressure on the wound, tamponade of the wound, pressure bandage (Israeli bandage).
4. Indications and technique of applying different types of harnesses and improvised twists.
5. Indications and rules for the use of chemicals to stop bleeding.

### **Practical work (tasks) performed in class:**

1. Applying Esmarch's tourniquet, twist, pressure bandage, belt;
2. Stop bleeding with finger pressure on all parts of the human body;
3. Apply chemical hemostatic agents;
4. Carry out tamponade of wounds;

### **Topic content:**

**Bleeding** is the outpouring of blood through a damaged vessel. Depending on where the blood is shed, bleeding can be external or internal.

1. **External bleeding.** It can be different depending on the damaged vessels: arterial, venous, capillary and mixed.

Bleeding is traumatic, caused by damage to blood vessels, and non-traumatic, associated with their destruction by any pathological process or increased permeability of the vascular wall.

Depending on which vessels were damaged and the ways to stop them, bleeding is divided into:

- arterial;
- venous;
- capillary.

### ***Arterial bleeding***

Signs of arterial bleeding: blood is bright red, flowing in a pulsating stream, thrusts, simultaneously with the heartbeat. Pressing the artery above the site of injury stops the bleeding.

### ***Venous bleeding***

With venous bleeding, the blood is darker, flows continuously, no obvious flow is observed. When lifting the limb up, the bleeding decreases or stops.

### ***Capillary bleeding***

Capillary bleeding is caused by damage to small blood vessels in the skin, subcutaneous tissue and muscles. In this case, the entire wound surface bleeds. The color is dark red. This bleeding is dangerous in diseases that are accompanied by a decrease in the ability of blood to coagulate (Pict. 49).

At rendering of home medical care carry out a temporary stop of external bleeding.

### **Bleeding can be temporarily stopped in one of the following ways:**

press the main vessel above the bleeding site with your finger, press and bend the limb as much as possible, apply a tourniquet, apply a primary and compressive bandage.

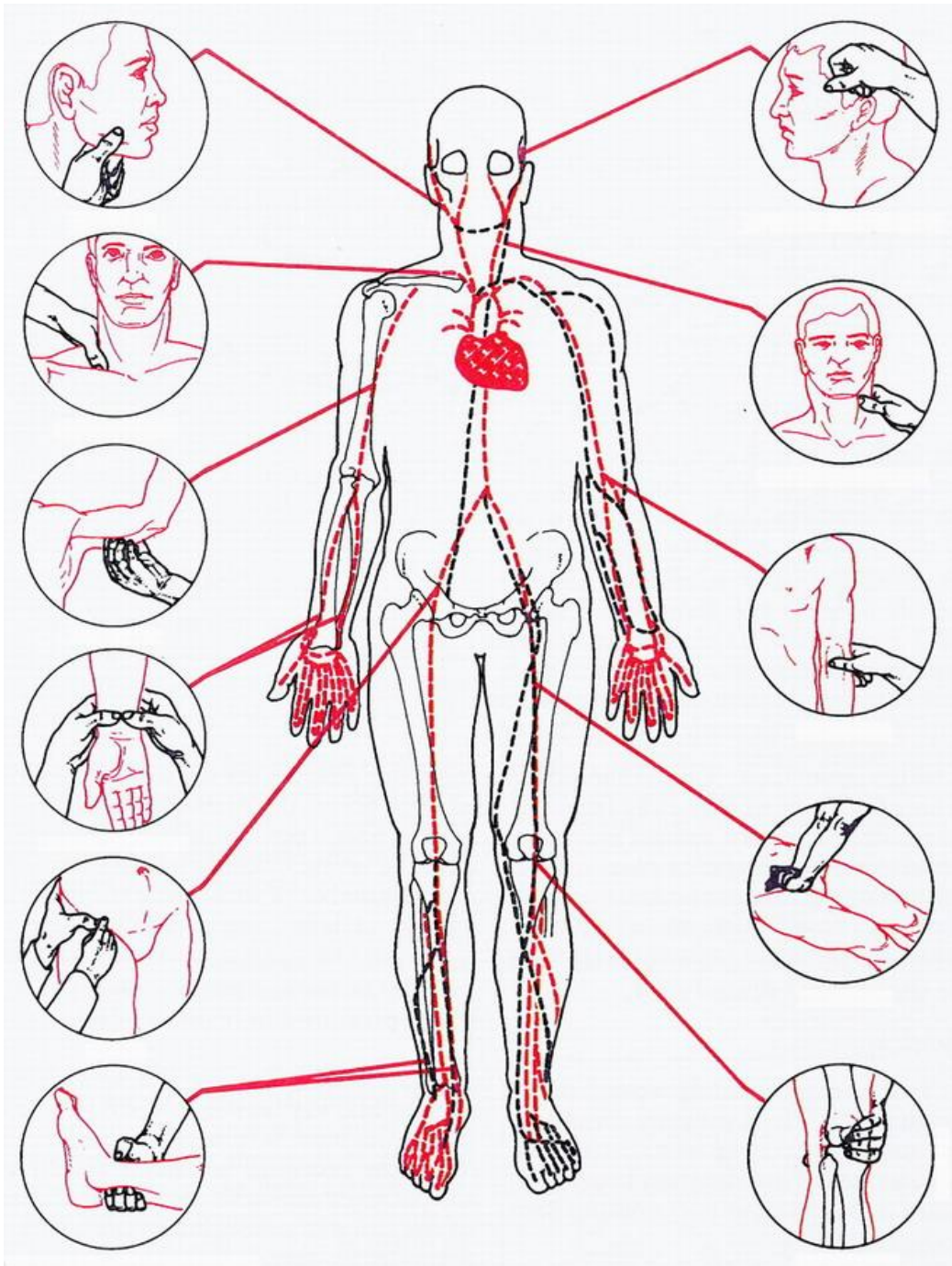
***WARNING!!!*** When working with the wounded - do not forget about your safety !!!  
*Put on disposable rubber or latex gloves before the examination and start providing home medical care !!!*

Press the artery with your fingers to the bones or the surface of the joints, in order to stop the bleeding, you can under any circumstances.

The pressure is applied not in the wound, but higher - closer to the heart, before applying a tourniquet or bandage.

To skillfully and quickly stop bleeding in this way, you need to know well the places of compression of the arteries. Find the artery by pulse, press it to the nearest bones above the wound, to stop the pulse and stop the bleeding.

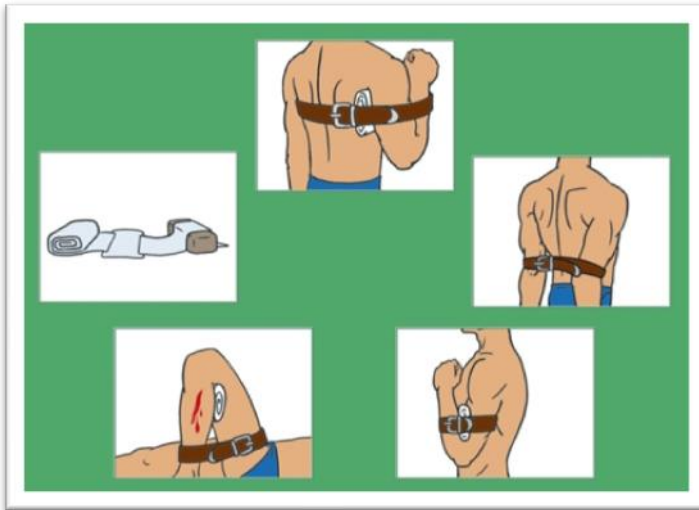
At arterial bleeding the vessel is pressed above a wound place, and at bleeding from a vein - below a wound (pict. 50).



**Pict. 2. The scheme of the main arterial vessels and places their finger pressing**

The method of stopping bleeding by maximum flexion of the limbs is based on the maximum flexion of the limb in the joint above the wound (resulting in compression of the main vessel), and subsequent fixation of the limb in this position with a bandage, belt or other material (you can use a wrapped sleeve or pants).

Be sure to place a small cloth roller on the flexion surface of the elbow or knee joint. Every soldier must have a service harness (turnstile) ready for use and in an accessible designated place (for example, the left upper unloading bag) and be trained to use it.



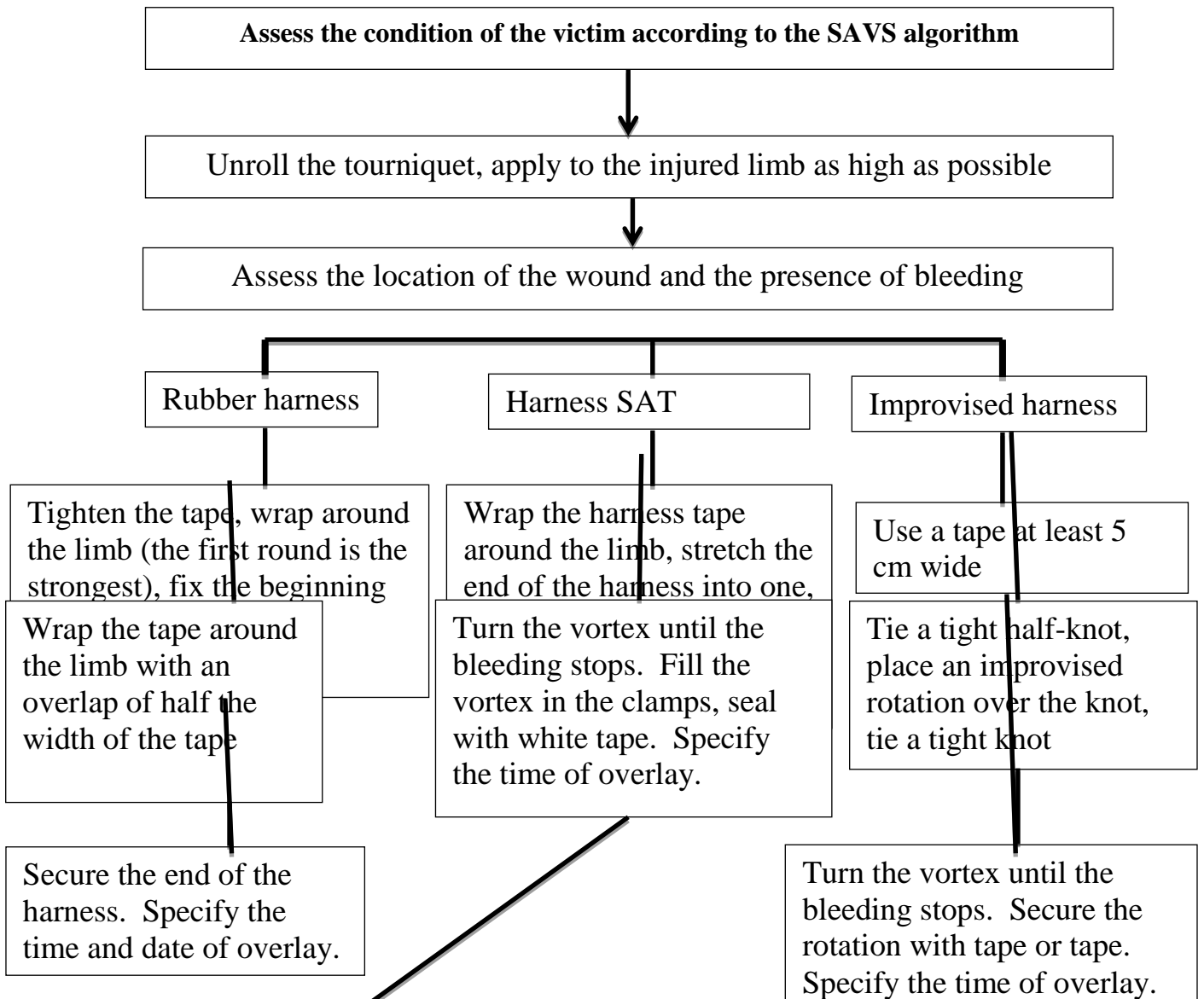
**Pict. 3. Stopping bleeding by maximum flexion of the limbs**

On the line of fire - in the sector of fire, the wounded must easily and quickly get his own tourniquet (turnstile) from any position.

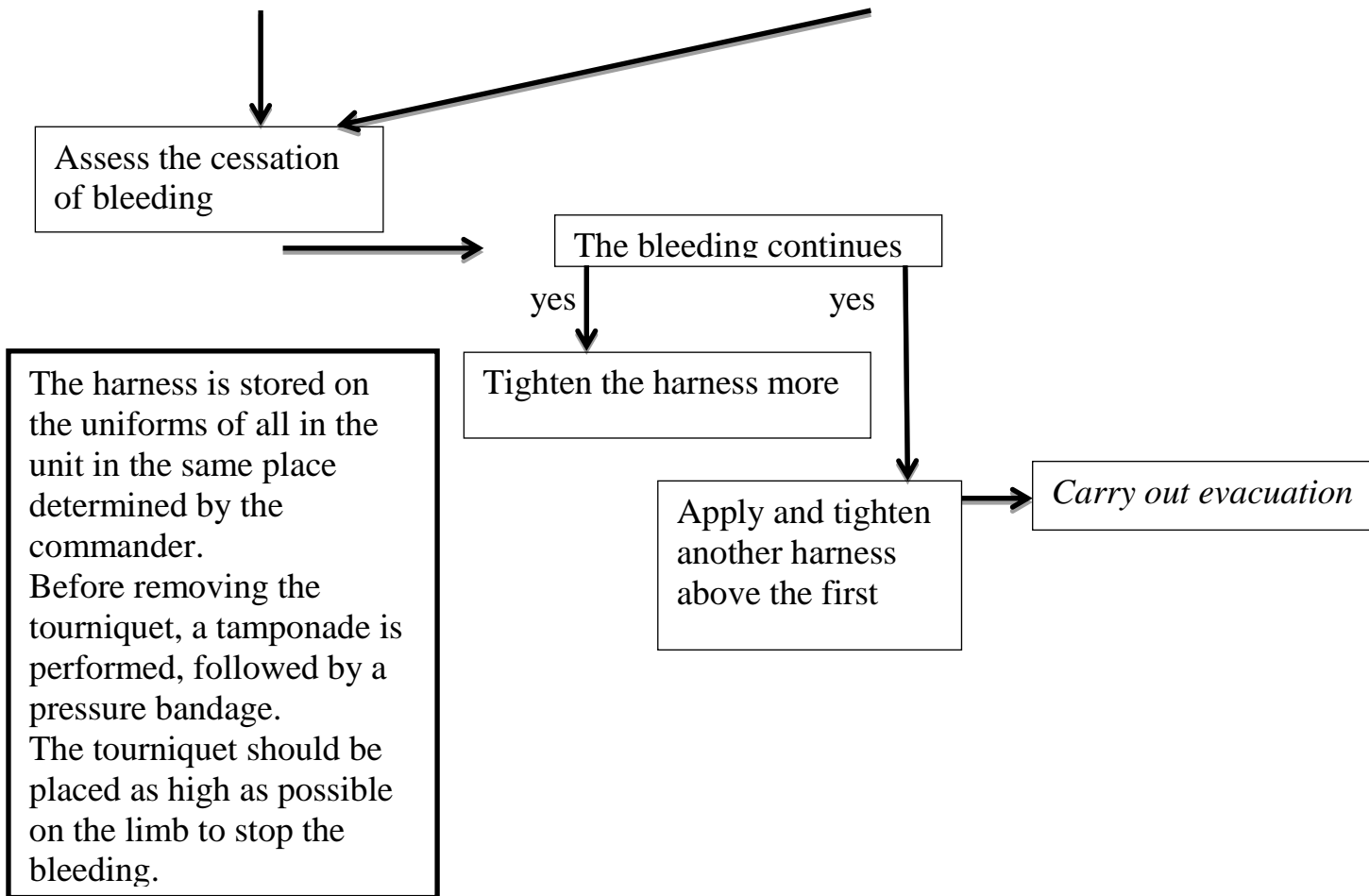
The tourniquet can be applied on one (or more if necessary) 4 points - both shoulders or both thighs on top of clothes.

**WARNING!!!** No need to hide your harness (turnstile) at the bottom of the first aid kit !!!

### BLEEDING STOPPING ALGORITHM







The main causes of death of 80-90% of the wounded were massive blood loss and hypovolemic shock, which could have been avoided. In this case, the localization of injuries in 48% of cases - in the torso, in 31% - in the upper and lower extremities, in 21% - in the neck or groin, where the main blood vessels. As a rule, critical bleeding is a stream of blood from an artery, and significant blood loss is possible after 30 seconds, which significantly limits the time of home care on the battlefield:

- at bleeding from the main vessels of extremities (femoral, shoulder) the wounded dies till 2 min. (localization of the wound - the shoulder (armpit) or thigh (groin)). cause of death - rapid loss of a significant amount of blood;
- with bleeding from the vessels of the neck (carotid artery, jugular vein) death also occurs up to 2 minutes (wound localization - neck area). causes of death - rapid loss of significant amounts of blood, suction of air into large veins and closure of blood vessels;
- when bleeding from the vessels of the head, the wounded may die from a few seconds to one hour (localization of the wound - the scalp). causes of death - rapid loss of a significant amount of blood, suction of air into large veins and blockage of blood vessels;
- with external arterial bleeding from wounds of the forearm, leg or torso, death can occur within one hour. causes of death - rapid loss of a significant amount of blood, the development of shock.

Therefore, proper assessment of bleeding and timely home care is very important to save the lives of wounded participants in armed conflicts.

### **Imposition of a plait (turnstile).**

A sign of critical bleeding is amputation of the limb, a fountain of blood from the wound, or a spot of blood more than 20-30 cm in diameter.

Apply a tourniquet without removing clothing, making sure that the place of application is above the place of bleeding (as close as possible to the torso).

You may need a second tourniquet that is placed above the first to stop the bleeding. Do not place the tourniquet on the knee or elbow. At initial imposing of a plait impose it as the highest on an extremity.

Do not place the tourniquet directly over a holster or a filled pocket that contains any items.

If the bleeding from the limb is strong enough, you need to put a tourniquet on the limb above the bleeding site and tighten it by twisting to stop the bleeding. Use a special harness made of elastic rubber (Esmarch), or a harness made of improvised material.

A note should be attached to the harness indicating the exact time of application.

Given that the note may be lost during the evacuation, information about the time of application of the tourniquet should be duplicated on the forehead or cheek (for example, T 18.15).

*WARNING!!! Inscriptions on the body should be applied with a permanent marker or green.*

*Do not use iodine solution because it is quickly washed away and absorbed by the skin.*

The tourniquet should be on the limb for as little time as possible. It is obligatory to lower it every 30-40 minutes. (in the case of a rubber harness, shifting above).

Loosen the tourniquet for 15-30 seconds and assess the patient's condition:

Temperature, pulse, respiratory rate, pressure, skin appearance (pale, cold, sweaty, pink, warm, dry), O<sub>2</sub> saturation, state of consciousness, mental state, pain scale (1-10). If there are no changes in consciousness and respiration, and the bandage on the wound has not become intensely soaked with blood, the tourniquet should be allowed for 3-5 minutes. After loosening the harness, it should be placed slightly above the previous place.

If there is no change in consciousness and respiration, but the bandage on the wound has become intensely soaked with blood, you should let the tourniquet for 30 seconds, pre-make a finger pressure on the artery above the wound, repeat this maneuver three times. After loosening the tourniquet, it should be applied slightly above the previous place, according to the algorithm to stop the bleeding.

The maximum allowed time of stay of a plait on a body without allowance makes 1,5-2 h (1,5 h - Esmarch's plait, 2 h - SAT).

If the harness is applied correctly, then:

bleeding from the wound stops,  
the limb becomes pale and cold,  
the pulse below the tourniquet is not determined.

*The technique of applying a tourniquet type Esmarch.*

The skin under the tourniquet should be protected with a soft lining. If the tourniquet is placed on clothes, it is straightened so that there are no folds. The person applying the tourniquet is located on the outside of the limb, and the tourniquet is held on the inside. One hand grasps the end of the tourniquet, and the other - its middle part so that one hand is above and the other - below the limb. The tourniquet is stretched (the first round is important to stretch as much as possible), wrapped around the limb and tightened until the bleeding from the wound stops and the pulse on the periphery of the limb disappears. The next round is imposed with less, and the last - with minimal tension. All circular rounds are stacked side by side, not allowing skin folds between them. It is fixed (fig. 52).



**Fig. 4. The technique of applying a tourniquet type Esmarch**

***Disadvantages in use:***

- it is impossible to make a controlled assumption;
- quite strongly slips in hands if damp (for example, from blood);
- some manufacturers stamp on a plait names of the firm, TU or GOST, etc., often because of these stamp they also burst;
- difficult to apply with one hand;
- the weakest place where there are holes for fasteners (buttons);
- it is not convenient enough and fast to fix them;
- can not be applied to bare skin;
- not always convenient for application due to the large length;
- unsuitable for use at temperatures below 5oC.

Dimensions of the Esmarch harness: 1400x25 mm.

Shelf life - 5 years from the date of manufacture. Service life - 1 year.

***Technique of imposing a turnstile like SAT.***

In 2005, the US Army's 10 best inventions included the Combat Application Tourniquet (CAT), a velcro strap and windlass consisting of a clamp, a strap, and a plastic stick. Applying this harness is possible with one or both hands. The peculiarity of the design allows to stop arterial bleeding on the arm and leg equally effectively.

***Features of application of turnstile like SAT:***

When assisting in the firing sector, place the harness on the limb as high as possible and on top of the uniform. (This will be changed by moving it to the skin and 5 cm above the injury in the shelter sector).

Stretch the free end (red / white) of the harness tape through the entire buckle (as on a regular belt). If there is a wound on the arm, pull the free end (red / white) of the tourniquet tape through the near half-ring of the buckle.



Stretch the harness tape tightly around the limb and secure it as tightly as possible.



Scroll to stop the bleeding. This can be achieved in 2-4 turns of the wheel.

Secure the swivel in the swivel clasp.

Check for distal pulse.

Fasten the tape to write the time.

Secure the free end of the harness tape.

***NOTE:*** *If the tactical situation allows it - check the pulse on the limb below the tourniquet. If the pulse is still present, apply another tourniquet closer to the body than the first tourniquet. Tighten it and check the pulse again.*



Mark the time of application of the tourniquet.

The main mistakes when applying a turnstile:

Applying it with minimal bleeding.

Applying it below (distal) the bleeding site.

Do not weaken it when it takes time to allow blood to enter the injured limb.

Remove it if unconscious, or when there is an emergency evacuation.

Not dense overlay - the turnstile should exclude a peripheral pulse.

Do not use the second turnstile, if necessary

Wait a long time to impose it.

***N.B. The use of a harness in the shelling sector***

*Rapid use of tourniquets (tourniquets) to stop bleeding is crucial in this sector;*

*Each soldier must have a suitable harness ready to use and in an accessible standard place (upper left unloading bag) and be trained to use it.*

*The wounded must easily and quickly get their own tourniquet (turnstile).*

*Do not hide your tourniquet at the bottom of your first aid kit !!!*

*The tourniquet can be applied on one (or more if necessary) 4 points - both shoulders or both thighs on top of clothes.*

*In case of velcro damage (snow, swamp), you need to use two slots in the turnstile buckle.*

***An improvised tourniquet*** is a means of pulling the limb and stopping blood flow. In essence, the improvised tourniquet is a modern analogue of the medical tourniquet, a simpler surgical instrument for clamping blood vessels.

The simplest turnstile that can be made in the field is a piece of cloth and a lever for pressure, for example - an ordinary stick or other straight object. Wrapping the limb with a cloth, insert the lever and start twisting. The limb should be pulled until blood flow and bleeding are stopped. To prevent loosening, secure one end of the lever, such as another piece of cloth.

As a rule, the turnstile consists of dense fabric or leather belts, supplied with appropriate buckles for fastening.

The main disadvantage of the turnstile is the lack of elasticity. This negative moment of impact of turnstiles and can lead to damage of the tissues which are subject to pressure (especially nerves).

The main advantage of the turnstile is its unique strength. Elastic rubber tourniquets, which are used in modern medicine, are not suitable for derivative conditions - they are quite fragile and very easy to tear. If you pay attention to any first aid kit - it is possible to note that instead of harnesses they are equipped with turnstiles. The rubber harness does not withstand friction or collisions with the sharp edges of stones or tree branches, while the turnstile easily copes with this task. The fixation of the turnstile is also much stronger - as a rule, they are equipped with a non-slip system and a system of moisture resistance.

However, keep in mind that a turnstile is not a toy, but a serious medical device. When using a turnstile, or just dragging the limb, you need to understand that it is possible to do no more than 15 minutes! It is necessary to dose the pressure, in any case not ignoring the fully contracted limb. If possible, the pressure should be minimized when the bleeding stops. In case of careless handling of the turnstile (if you do not remove it for more than two hours) - in the squeezed limb may begin tissue necrosis.

### **Materials for self-control:**

#### **Situational problem №1**

The victim had a cut wound in the area of the left elbow joint. Pulsating bright red bleeding from the wound. You have nothing but a bandage and a trouser belt.

1. What measures to temporarily stop external bleeding will you suggest.
2. Follow your suggested optimal method of temporarily stopping bleeding.

#### **Situational problem №2**

The victim had a cut wound of the neck closer to the projection of the subclavian artery.

1. Indicate the amount of first aid.
2. Demonstrate the proposed activities on the phantom.

#### **Situational problem №3**

The victim, N., received a stab wound to the inner surface of the lower third of his right shoulder. Pulsating bright red blood from the wound. Pulsation on the a.radialis is absent. The victim was placed on his back, the right upper limb was given a raised position.

1. Determine the optimal method of temporary cessation of bleeding.
2. Follow the optimal method of temporary cessation of bleeding.

#### **Situational problem №4**

A private received a shrapnel wound to the neck during the fighting. Examination revealed a soft tissue wound in the right neck. From the wound pulsating bleeding is bright red.

1. What method of temporary cessation of bleeding should be used?

2. Follow the optimal method to stop the bleeding.

### **Situational problem №5**

The victim, 35, was hit by a car. The condition is severe, unconscious. Diagnosed with combined skeletal and traumatic brain injury. Objective: in the area of the right shoulder wound 5x5x2 cm with bleeding. Pulse 120 beats per minute, blood pressure 100/60 mm Hg. Art.

1. Determine the Algover index.
2. In what position should the victim be transported? Demonstrate.

### Literature

#### Basic references

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